

## Complete Summary

### **GUIDELINE TITLE**

Diagnosis and treatment of forefoot disorders. Section 2. Central metatarsalgia.

### **BIBLIOGRAPHIC SOURCE(S)**

Clinical Practice Guideline Forefoot Disorders Panel, Thomas JL, Blitch EL IV, Chaney DM, Dinucci KA, Eickmeier K, Rubin LG, Stapp MD, Vanore JV. Diagnosis and treatment of forefoot disorders. Section 2. Central metatarsalgia. J Foot Ankle Surg 2009 Mar-Apr;48(2):239-50. [55 references] [PubMed](#)

### **GUIDELINE STATUS**

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT

SCOPE  
METHODOLOGY - including Rating Scheme and Cost Analysis  
RECOMMENDATIONS  
EVIDENCE SUPPORTING THE RECOMMENDATIONS  
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS  
IMPLEMENTATION OF THE GUIDELINE  
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT  
CATEGORIES  
IDENTIFYING INFORMATION AND AVAILABILITY  
DISCLAIMER

## SCOPE

### **DISEASE/CONDITION(S)**

Central metatarsalgia, including:

- Capsulitis
- Metatarsal abnormalities
- Metatarsal stress fractures
- Other abnormalities including second metatarsophalangeal joint (MPJ) instability, avascular necrosis, tumor, foreign body, infection

### **GUIDELINE CATEGORY**

Diagnosis  
Evaluation

Management  
Treatment

## **CLINICAL SPECIALTY**

Family Practice  
Orthopedic Surgery  
Pathology  
Podiatry  
Radiology  
Rheumatology  
Sports Medicine

## **INTENDED USERS**

Physicians  
Podiatrists

## **GUIDELINE OBJECTIVE(S)**

To provide recommendations for the diagnosis and treatment of central metatarsalgia

## **TARGET POPULATION**

Patients with central metatarsalgia

## **INTERVENTIONS AND PRACTICES CONSIDERED**

### **Diagnosis/Evaluation**

1. Comprehensive history and review of symptoms including pain, swelling, stiffness, altered range of motion
2. Radiographic evaluation including weightbearing anterior-posterior (AP), lateral, oblique and plantar axial views
3. Additional diagnostic studies such as magnetic resonance imaging (MRI), computed tomography (CT), ultrasound, bone scan, arthrography, pedobarographs

### **Management/Treatment**

1. Nonsurgical treatment such as padding, orthotics, shoe modifications, off-loading, immobilization, corticosteroid injections, nonsteroidal anti-inflammatory drugs (NSAIDs), assessment of biomechanical faults, consultation/referral if indicated
2. Surgical treatment including
  - Synovectomy
  - Capsuloligamentous repair
  - Metatarsal abnormality repair
  - Metatarsophalangeal joint (MPJ) arthroplasty
  - Partial metatarsectomy

## **MAJOR OUTCOMES CONSIDERED**

Treatment complications

## **METHODOLOGY**

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Searches of Electronic Databases

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

A search of medical literature was performed using the EndNote, Medline/PubMed, National Library of Medicine, and Science Direct databases from 1950 to 2008. The terms used were metatarsal, MTP joint, MPJ, lesser metatarsalgia.

### **NUMBER OF SOURCE DOCUMENTS**

Not stated

### **METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE**

Weighting According to a Rating Scheme (Scheme Not Given)

### **RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE**

Not applicable

### **METHODS USED TO ANALYZE THE EVIDENCE**

Review

### **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

Not stated

### **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

### **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Not stated

### **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

Not applicable

## **COST ANALYSIS**

A formal cost analysis was not performed and published cost analyses were not reviewed.

## **METHOD OF GUIDELINE VALIDATION**

External Peer Review  
Internal Peer Review

## **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

Not stated

## **RECOMMENDATIONS**

### **MAJOR RECOMMENDATIONS**

The recommendations for the diagnosis and treatment of central metatarsalgia are presented in the form of an algorithm with accompanying annotations. An algorithm is provided for central metatarsalgia. Annotations follow.

#### **Central Metatarsalgia (Pathway 3)**

Central metatarsalgia involves pathology of the second, third, and fourth metatarsals and their respective metatarsophalangeal joints (MPJs). Metatarsal pathology may be secondary to a variety of problems including trauma, length abnormalities, structural deformity, and others. Pathology of the central MPJs is also secondary to numerous different etiologies and encompasses both osseous and soft tissue conditions.

#### **Significant History (Pathway 3, Node 1)**

Patients presenting with complaints related to the second, third, and fourth metatarsals and their respective MPJs typically relate a history of pain in the area of the ball of the foot, with or without swelling and/or discoloration. They may report a history of partial or complete stiffness of the affected joint(s). Symptoms are usually of gradual onset, tend to be progressive in nature, and may have been aggravated by a recent change in activity or footwear. Frequently there is no history of trauma. Related complaints may include the development of plantar calluses in the area of where symptoms occur as well as a gradual change in appearance or position of one or more toes.

#### **Significant Findings (Pathway 3, Node 2)**

Examination of the patient with central metatarsalgia symptoms may reveal edema and/or inflammation in the area of the involved metatarsal(s) or MPJs. Pain on palpation of the affected metatarsal or joint is typically present. Pain involving the MPJ usually is exacerbated upon reaching end range of motion with manual testing. Decreased range of motion or crepitus may indicate arthrosis or

other osseous changes at the MPJ. Alternatively chronic hyperextension of the MPJ may predispose the plantar plate and collateral ligaments to attenuate and rupture. In these joints, manual stress testing of the lesser MPJ may demonstrate instability as evidenced by dorsal translocation of the digit at the metatarsal head. Typically patients with plantar plate rupture have pain with palpation plantarly at the metatarsal head or flexor crease of the affected MPJ.

Change in position or alignment of the toe may or may not be seen in central metatarsalgia, as patients may present with complaints of pain at the MPJ prior to the development of associated digital deformities. If digital deformities are present, they may be multiplanar, flexible, or nonflexible. A hyperkeratotic lesion plantar to the affected metatarsal or MPJ may be present and may contribute to the patient's symptomatology (see Figure 1 in the original guideline document). Diagnostic blocks often are of great help in localizing the area of the patient's symptoms and establishing an accurate diagnosis.

### **Diagnostic Testing: Radiographic Evaluation (Pathway 3, Node 3)**

Radiographic evaluation of the patient with central metatarsalgia symptoms should include weightbearing anterior-posterior (AP), lateral, and oblique views. A plantar axial view may also be beneficial in evaluating the structure and position of the central metatarsal heads.

Radiographs are evaluated for both soft tissue and osseous changes. Soft tissue is investigated for edema, foreign bodies, and other abnormalities. Joint dislocation, subluxation, or irregularities of the metatarsal head or phalangeal base may be seen. Alignment of the second, third, and fourth MPJs as well as any abnormalities of the metatarsal parabola are assessed on the AP radiograph (see Figure 2 in the original guideline document). The presence of degenerative and/or avascular changes may be indicated by erosions, joint space narrowing, subchondral cysts, osteophyte formation, sclerosis, and alteration in the normal contour of the metatarsal head. A metatarsal stress fracture may or may not be radiographically apparent. Indeed, the first radiographic evidence of a stress fracture may be reflected by healing bone callus several weeks after the fracture had occurred (see Figure 3 in the original guideline document).

### **Additional Diagnostic Imaging Studies (Pathway 3, Node 4)**

Evidence of pathology at the MPJ joint or metatarsal may be further substantiated with the use of magnetic resonance imaging (MRI), computed tomography (CT), diagnostic ultrasound, radionuclide scanning, and arthrography. These more advanced imaging techniques may assist in determining the presence and extent of both soft tissue and osseous damage in this area of the foot.

MRI, CT, and radionuclide scanning are helpful in determining the presence of metatarsal stress fracture or articular pathology such as an arthritide, Freiberg's infraction, or plantar plate rupture not appreciated radiographically. Ultrasound may support clinical evidence of soft tissue trauma/edema and may offer an alternative diagnostic aid for suspected plantar plate ruptures. The use of intra-articular radio-opaque dye is beneficial in documenting a plantar plate rupture if extravasation of the dye is found to be present. Plantar pressure studies may be helpful in identifying weightbearing anomalies of the forefoot.

### **Diagnosis (Pathway 3, Node 5)**

Establishment of the correct diagnosis may be very challenging as quite a variety of pathologies may be etiologic of pain in this anatomic location. These include:

- Capsulitis (mechanical, arthritic, or secondary to second MPJ instability)
- Metatarsal abnormalities (dorsiflexed, elongated, plantarflexed, shortened, hypertrophic plantar condyles and first ray hypermobility)
- Metatarsal stress fracture
- Second MPJ Instability
- Other (avascular necrosis, tumor, foreign body, infection)

#### *Capsulitis (Pathway 3, Node 6)*

Capsulitis of the central MPJs may be secondary to mechanical or arthritic etiologies (see Figure 4 in the original guideline document). Mechanical causes include any condition that results in increased forces through the joint itself as well as overload to the plantar metatarsal head. This may be associated with tears of the plantar plate or ligament disruption. Arthritic conditions include any of the inflammatory arthritides such as rheumatoid arthritis and many of the seronegative arthritides. Laboratory testing often is indicated in the establishment of an arthritic process. In the case of a mechanical etiology of capsulitis, treatment includes offloading and management of any contributing biomechanical abnormality with padding and/or orthotic therapy. Oral anti-inflammatory medication as well as local injection of a corticosteroid also may be beneficial. If the patient fails to respond appropriately to these measures, surgical treatment may be necessary. This would include synovectomy along with correction of any contributing pathology (e.g., metatarsal abnormality) and repair of any capsuloligamentous tears if present (see Node 9 below).

When arthritis of the MPJ is the cause of capsulitis, attempts should be made to establish an accurate diagnosis of the arthritic process involved. These attempts include the previously-mentioned laboratory testing, as well as joint aspiration and rheumatologic consultation/referral if indicated. Treatment for an inflammatory arthritic condition of the central MPJs includes all of the nonsurgical and surgical alternatives previously listed for mechanically-induced capsulitis. In addition, arthroplasty-type procedures may be necessary to remove painful osteophytes, remove loose bodies, perform other procedures such as chondroplasty or joint implantation. In some cases, metatarsal head resection may at times also be considered, but this usually is done only in the presence of significant deformity, such as in the performance of pan metatarsal head resection in the setting of rheumatoid arthritis (see Figure 5 in the original guideline document).

#### *Metatarsal Abnormality (Pathway 3, Node 7)*

Sagittal plane abnormalities of the central metatarsals may be the result of anatomical variations that are congenital, developmental, or acquired (perhaps from trauma or prior surgery). These abnormalities can manifest themselves as dorsiflexed (elevated), elongated, plantarflexed, and shortened metatarsals, or as hypertrophic plantar condyles. Hypermobility of the first ray may result in a lateral transfer of stress away from the first metatarsal, with resultant symptoms. Any of

these conditions, either alone or in combination, can cause increased load or pressure around one or more of the central metatarsals, producing pain, bursal formation, and/or a hyperkeratotic lesion.

Refer to the original guideline document for detailed description of metatarsal abnormalities.

Each of these conditions creates similar symptomatology in the area of the metatarsal with the deformity or in the area of adjacent metatarsals. Elongated or plantarflexed metatarsals as well as metatarsals adjacent to an elevated metatarsal sustain increased weightbearing forces. In addition, metatarsals with hypertrophy of the plantar condyles show a similar pattern of increased forces and possible focal keratoses at the level of the condyles.

Nonsurgical treatment involves medications, offloading the painful joint or metatarsal head, and treating any associated biomechanical pathology. Treatment includes padding, orthoses, and rocker-bottom shoe modifications. Nonsteroidal antiinflammatory drugs and corticosteroid injections may also be used.

Surgical treatment is indicated for those patients who fail to respond to nonsurgical care or for patients in whom nonsurgical care would not be considered beneficial. Dorsiflexed (elevated) metatarsals are surgically treated by an osteotomy at either the proximal or distal aspect of the metatarsal to plantarflex the metatarsal with the goal of reestablishing the normal weight bearing pattern of the forefoot. Care must be taken to avoid over- or under-correction of the deformity.

Structurally plantarflexed metatarsals are surgically treated by an elevating osteotomy at either the proximal or the distal aspect of the metatarsal to re-establish the sagittal plane alignment of the bone and a normal metatarsal parabola (see Figure 6 in the original guideline document). Care must be taken to prevent common complications of excessive elevation or shortening resulting in transfer lesions or metatarsalgia. Painful dorsal exostosis or prominence secondary to excessive elevation and floating toe/lack of toe purchase may also occur.

Surgical procedures for a shortened metatarsal include acute or gradual lengthening of the metatarsal, soft tissue release, correction of associated digital deformity, and in some cases syndactyly. Specific techniques used for metatarsal lengthening include metatarsal osteotomy, bone grafting, and distraction osteogenesis. Potential complications include under- or over-correction, decreased joint motion, delayed union, nonunion, malunion, or graft failure. Amputation at the MTP joint should be avoided because of the risk of subsequent adjacent toe deformity.

Surgical treatment of enlarged plantar condyles is performed when the symptoms of metatarsalgia are due to the prominence and resultant increased pressure or load caused by this abnormality. Surgical treatment of enlarged plantar condyles involves remodeling or resection (condylectomy) of the involved metatarsal condyles. If other etiologic factors such as those described previously are determined to exist, consideration should be given to other procedures to treat the coexisting deformity.

Operative treatment of first ray hypermobility may be necessary in some instances. This is usually done via medial column arthrodesis.

#### *Metatarsal Stress Fracture (Pathway 3, Node 8)*

Stress fractures of the central metatarsals develop when the bone is subjected repetitively to sub-failure loads. Stress fractures make up as much as 20% of all sports-related injuries. A greater incidence of these injuries among females has been reported. Patients with chronic inflammatory arthropathies, severe osteoporosis, marked joint deformity, or those who receive chronic corticosteroid therapy are at high risk of developing stress fractures. Stress fractures of the second metatarsal base are most commonly seen in dancers. Although the length of the first metatarsal has been implicated as a risk factor for weight transference, equivalent rates of fracture in short, average, and long first metatarsal conditions have been reported. Numerous studies have shown that abnormal mechanics of the first ray may transfer weight to the adjacent metatarsals and lead to stress transference and fracture of the adjacent metatarsal.

The majority of metatarsal stress fractures occur in the second and third metatarsals. Radiographic examination may be normal for several weeks after the onset of symptoms. In cases of uncertain diagnosis or in cases where more aggressive treatment might be indicated (i.e., high performance athletes), a technetium bone scan, MRI, or CT scan may assist in the early detection of a stress fracture.

The primary treatment of a central metatarsal stress fracture is immobilization and offloading with the use of a walking boot or surgical shoe along with activity modification. Proper shoes and orthoses are used to control abnormal biomechanical influences and may relieve symptoms. Failure to address pre-existing biomechanical abnormalities that result in metatarsal stress fractures can lead to complete fracture or possible recurrence. Return to regular activity or sport is allowed once adequate fracture healing has been accomplished. In the event of malunion, the metatarsal may become elevated, plantar-flexed, and/or shortened and this may increase the load to adjacent metatarsals. Surgical treatment of a metatarsal stress fracture is rarely necessary. However, surgery may be required in cases of complete fracture, failure to heal with usual nonsurgical measures, or in cases of malunion.

#### *Other (Pathway 3, Node 9)*

Other causes of central metatarsalgia-related symptoms also exist. These include second MTP joint instability, avascular necrosis, tumor, foreign body, and infection.

#### Second MPJ Instability

The second MPJ is most frequently implicated in MPJ instability. Second MPJ instability with or without inflammation of the articular and periarticular structures can lead to multiplanar malalignment. Second MPJ instability has been described as predislocation syndrome, plantar plate dysfunction, mono-articular non-traumatic synovitis, MPJ capsulitis and synovitis, metatarsalgia, and crossover second toe deformity. Many factors that include both mechanical and



inflammatory conditions have been described to contribute to this condition. Possible mechanical causes include trauma to the plantar plate and supporting ligaments and joint capsule; an elongated second metatarsal; Freiberg's infraction; prior surgical intervention; congenital deformities; and the forces produced on the second MTP joint by an adjacent hallux valgus deformity. Inflammatory conditions such as isolated synovitis or systemic inflammatory arthropathies may be causative factors as well.

The confirmation of an unstable joint is determined by clinical and radiographic evaluations (see Figure 8 in the original guideline document). This condition is characterized by pain and inflammation of the second MPJ and varying degrees of digital deviation in the transverse and sagittal plane. As the condition progresses a positive dorsal stress test on the digit at the MPJ (drawer test) reveals subluxation and, sometimes in later stages, dorsal dislocation. Transverse plane deviation of the digit may be better appreciated on weightbearing examination and is commonly present with sagittal plane instability. It should be noted that clinical instability at the MPJ is not necessarily pathognomonic for a plantar plate rupture; rather it may be identified in patients with ligamentous laxity and chronic plantar plate attenuation.

Weightbearing radiographic evaluation reveals the joint alignment changes. MRI and arthrography may be beneficial in further delineating the competency of the plantar plate.

Nonsurgical treatment may involve offloading of the second MPJ, splinting or taping of the second toe, orthoses, rocker-bottom shoe modifications and metatarsal padding. Nonsteroidal anti-inflammatory drugs and corticosteroid injections also may be used.

Surgical treatment is indicated for those patients who have failed nonsurgical care or for patients who are not candidates for nonsurgical treatment. Surgical correction is aimed at restoring the alignment and function of the second MPJ and any associated digital deformity. Surgical options include interphalangeal joint arthrodesis, flexor tendon transfer, reefing of the plantar-lateral capsule, collateral ligament repair, plantar plate repair, MPJ arthroplasty, and various metatarsal osteotomies.

#### Avascular Necrosis of the Metatarsal Head

A unique finding of the lesser MTP joint (typically the second) is osteochondrosis. Commonly referred to as Freiberg's infraction, these cartilage and osseous changes represent an avascular necrosis of the metatarsal head. Surgical management of this condition may include: distal metatarsal osteotomy, implant arthroplasty, resection arthroplasty and interpositional grafting, and interpositional soft tissue grafts.

#### Tumor

Pain and/or swelling in the forefoot may be secondary to tumors of soft tissue or bone. Timely diagnosis and any indicated consultation and/or referral are important. Treatment is specific to the type of tumor present.

### Foreign Body

Symptoms secondary to a foreign body in the forefoot are not uncommon. A symptomatic retained foreign body may be old or new and may be associated with a significant wound (laceration, gunshot or puncture wound) or show no discernable portal of entry. Excision of the offending foreign body is the treatment of choice. In the acute setting confirmation of tetanus prophylaxis is indicated.

### Infection

Infection of the central metatarsal area may be secondary to a variety of etiologies including puncture wound, foreign bodies, diabetic ulceration (see the National Guideline Clearinghouse [NGC] summary of the American College of Foot and Ankle Surgeons [ACFAS] guideline [Diabetic Foot Disorders: a Clinical Practice Guideline](#)), laceration, fungal infections, etc. It may involve joint, soft tissue, bone or occur in combination. Identification of the anatomic structure(s) involved and the causative organism(s) will direct treatment.

## **CLINICAL ALGORITHM(S)**

A clinical algorithm is presented in the original guideline document for central metatarsalgia.

## **EVIDENCE SUPPORTING THE RECOMMENDATIONS**

### **TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS**

The type of supporting evidence is not specifically stated for each recommendation.

This clinical practice guideline is based upon consensus of current clinical practice and review of the clinical literature.

## **BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS**

### **POTENTIAL BENEFITS**

Appropriate diagnosis and treatment of central metatarsalgia

### **POTENTIAL HARMS**

- Common complications of surgical procedures include excessive elevation or shortening resulting in transfer lesions or metatarsalgia. Painful dorsal exostosis or prominence secondary to excessive elevation and floating toe/lack of toe purchase may also occur.
- Other complications include under- or over-correction, decreased joint motion, delayed union, nonunion, malunion, or graft failure.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

### IMPLEMENTATION TOOLS

Clinical Algorithm  
Foreign Language Translations  
Patient Resources

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Getting Better  
Living with Illness

### IOM DOMAIN

Effectiveness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Clinical Practice Guideline Forefoot Disorders Panel, Thomas JL, Blitch EL IV, Chaney DM, Dinucci KA, Eickmeier K, Rubin LG, Stapp MD, Vanore JV. Diagnosis and treatment of forefoot disorders. Section 2. Central metatarsalgia. J Foot Ankle Surg 2009 Mar-Apr;48(2):239-50. [55 references] [PubMed](#)

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

2009 Mar-Apr

### GUIDELINE DEVELOPER(S)

American College of Foot and Ankle Surgeons - Medical Specialty Society

### SOURCE(S) OF FUNDING

American College of Foot and Ankle Surgeons

## **GUIDELINE COMMITTEE**

Clinical Practice Guideline Forefoot Disorders Panel

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## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

Not stated

## **GUIDELINE STATUS**

This is the current release of the guideline.

## **GUIDELINE AVAILABILITY**

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Foot and Ankle Surgeons Web site](#).

## **AVAILABILITY OF COMPANION DOCUMENTS**

None available

## **PATIENT RESOURCES**

The following is available:

- Foot health facts: Foot and ankle conditions. 2009. Available in Spanish and English from the [American College of Foot and Ankle Surgeons consumer Web site](#).

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## **NGC STATUS**

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